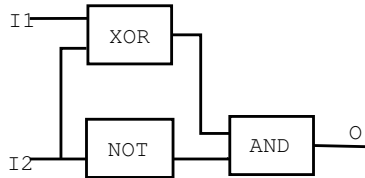


Due morning 12/15/03 for extra credit

Actual exam fill have lesser number of problems

- Suppose a typist could type 60 words per minute continuously day after day. How long would it take the typist to fill a CD whose capacity is 640MB? Assume one word is five characters and each character requires one byte of storage. Don't forget that space characters between words also consume storage.
- Find the output of the following circuit for all inputs and fill the table:



I1	I2	O
0	0	
0	1	
1	0	
1	1	

- Convert decimal number 231 to its binary representation and then convert from binary to hexadecimal representation. Check yourself by converting hexadecimal representation back to decimal.
- Convert hexadecimal 10F to binary representation and then from binary to decimal. Check yourself by converting decimal back to hexadecimal.
- Program counter (PC) is a part of:
  - Bus
  - Main memory
  - CPU
  - Device controller
  - Hard disk
- Find results of bitwise AND, OR and XOR:

01001101	01001101	01001101
AND 11100111	OR 11100111	XOR 11100111

7. What task will the following program perform when started with program counter equal to 30 (review problem 24, chapter 2)?

Address	Contents
30	20
31	03
32	21
33	01
34	22
35	00
36	23
37	10
38	14
39	00
3A	34
3B	10
3C	52
3D	21
3E	53
3F	31
40	32
41	39
42	33
43	3B
44	B2
45	48
46	B0
47	38
48	C0
49	00

8. There is a robot on a checked board (robot always occupies one square), at any moment of time it looks either north, east, south or west. It can turn left, right or step one square forward (in direction it looks); it can also check if a square in front of it is blocked (so it can determine if it can step forward or not).

At the beginning robot stands in the south-western corner. All squares are filled (blocked) with stones except for the only one passage from south-western corner to north-eastern corner (no forks or dead-ends, just one unique path).

Write a program for robot (pseudocode is probably the right choice of language) that will guide it to the north-eastern corner.

9. What is the least number of steps robot will have to make in order to reach the north-eastern corner?

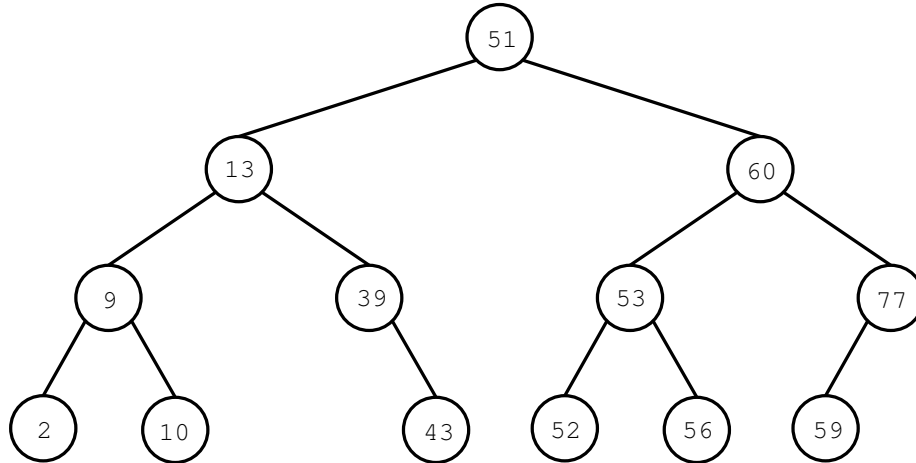
10. Convert the following fragment of code to equivalent using one `switch/case`-statement, no `if`-statements and no `goto`-statements:

```
    if(t==5)
        goto 2;
    goto 3;
2: printf("five");
    goto 9;
3: if(q==3)
    goto 1;
    goto 5;
1: printf("three");
    goto 9;
5: if(q==7)
    printf("seven");
    else
    printf("?");
9: printf("\n");
```

11. Please show step by step execution of the following code fragment and the output it will produce. Expression `sum%2` means remainder of division `sum` by 2.

```
int i,sum,a;
sum=0;
a=0;
for(i=0;i<7;i++)
{
    sum=sum+i;
    if(sum%2=0)
        a=a+i;
    printf("i=%d sum=%d a=%d\n",i,sum,a);
}
printf("i=%d sum=%d a=%d",i,sum,a);
```

12. Write a program that reads number  $N$  then  $2N$  numbers and prints sums of first and second number, third and fourth, ...,  $(2N - 1)$ th and  $2N$ th numbers.
13. Is the tree below a binary search tree? If not, which number was positioned incorrectly? Remove it from the tree and put in correct position.



14. Student records file has the following contents:

Student with SSN 987-65-4321  
 Student with SSN 111-11-1111  
 Student with SSN 222-33-3333  
 Student with SSN 111-22-3333  
 Student with SSN 999-88-7777  
 Student with SSN 123-45-6789

Build a binary search tree index for this file.

15. Build a hash table index for the file from the previous problem. For hash function use sum of SSN digits. Use hash table with 3 buckets (so actually you take sum of SSN digits modulo 3).